BLACK BOX®

NETWORK SERVICES

IC470A-F IC471A-F IC472A-F IC473A-F IC630A-F IC631A-F
IC470A-M IC471A-M IC472A-M IC473A-M IC630A-M IC631A-M

Async RS-232↔RS-422 and RS-232↔RS-422/530 Interface Converters

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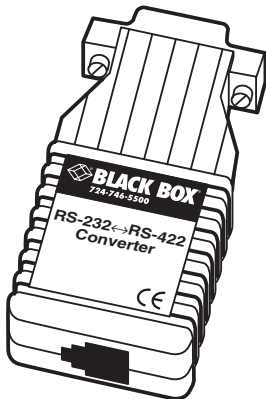
CUSTOMER SUPPORT INFORMATION

FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO-FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.
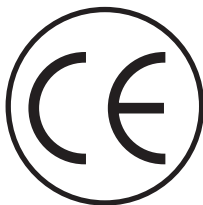
TRADEMARKS USED IN THIS MANUAL

AT&T is a registered trademark of AT&T.

Any other trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

DECLARATION OF CONFORMITY

This equipment has been tested and found to comply with the European Union's Electromagnetic Compatibility (EMC) directive and its Low-Voltage Directive (LVD).

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

Contents

Chapter   Page

1. Specifications

Cable Required — Between Converters: 4-wire (2-pair)
unconditioned twisted-pair cable

Compliance — CE; FCC Part 15 Subpart J Class A,
IC Class/classe A

Interfaces — To devices: EIA/TIA RS-232C:
IC470A, IC471A, and IC472A models:
Original pinning on DB25;
IC473A, IC630A, and IC631A models:
Pinned according to TIA-574 on DB9;
To line: EIA/TIA RS-422 or (IC471 and
IC472 models only) RS-530 (transmit- and
receive-data signals only)

Protocol — Asynchronous

Data Format — Transparent to data format

Flow Control — Transparent to software flow control
(X-ON/X-OFF, etc.); loops back RS-232
hardware flow-control signals (RTS, CTS,
DTR, DSR, and CD)

Operation — 4-wire; transparent to half- or full-duplex

Data Rate — Transparent to data rates up to 19,200 bps

Maximum
Distance —   Between device and Converter (RS-232):
                        50 ft. (15.2 m);
                    Between Converters (RS-422/530):
                        4000 ft. (1219 m)

User Controls — *IC470A, IC471A, and IC472A models only:*
                        (1) DTE/DCE slide switch (default setting
                        is DCE)

Indicators —   None

Connectors —   All end-mounted:
                        RS-232:
                            IC470A-F, IC471A-F, IC472A-F:
                                (1) DB25 female;
                            IC470A-M, IC471A-M, IC472A-M:
                                (1) DB25 male;
                            IC473A-F, IC630A-F, IC631A-F:
                                (1) DB9 female;
                            IC473A-M, IC630A-M, IC631A-M:
                                (1) DB9 male;
                        RS-422:
                            IC470A and IC473A models:
                                (1) 5-position terminal block;
                            IC630A models: (1) RJ-12 ("6-wire
                                RJ-11") female;
                            IC631A models: (1) RJ-45 female;
                        RS-422/530:
                            IC471A models: (1) DB25 female;
                            IC472A models: (1) DB25 male

RS-232↔RS-422 INTERFACE CONVERTERS

Power —   Very low voltage at 3 mA from the attached
                         device's RS-232 interface

MTBF —   Approximately 240,000 hours

**Maximum
Altitude —**   10,000 ft. (3048 m)

**Temperature
Tolerance —**   32 to 140˚F (0 to 60˚C)

**Humidity
Tolerance —**   Up to 95% noncondensing

Enclosure —   ABS plastic

Size —   IC470A, IC471A, and IC472A models:
                         2.2"H x 1.8"W x 0.8"D (5.6 x 4.5 x 1.9 cm);
                         IC473A, IC630A, and IC631A models:
                         2.5"H x 1.2"W x 0.8"D (6.4 x 3 x 1.9 cm)

Weight —   IC470A, IC471A, and IC472A models:
                         2 oz. (57 g);
                         IC473A, IC630A, and IC631A models:
                         3 oz. (85 g)

2. Introduction

2.1 Overview

With our Async RS-232↔RS-422 Converters (IC470A,
IC473A, IC630A, and IC631A product codes) and
RS-232↔RS-422/530 Converters (IC471A and IC472A
product codes), your computers, terminals, and
modems with RS-232 serial ports can communicate with
other devices using balanced RS-422 or RS-530 electrical
signals. These Converters derive the necessary power for
their operation from the data and control voltages on
the RS-232 interface. They perform full-duplex
bidirectional data conversion at RS-422/530 distances
up to 4000 feet (1219 m).

   Some converter models (the IC473A, IC630A, and
IC631A models) have DB9 RS-232 connectors for easy
attachment to the current generation of computers and
serial cables. The other Converter models (IC470A
through IC472A models) have DB25 RS-232 connectors
for attachments to modems, older computers and
terminals, serial printers, etc. To make it possible for you
to directly connect them to such a wide range of
equipment, the DB25 models have a DCE/DTE slide

switch you can set to complement your devices. (The DB9 models don't have this switch—they're always DCE—so you'll need a DB9 null-modem cable to connect them to a modem or a similar device.)

Converters are available with any of several RS-422 and RS-530 interface options. Of the models that carry RS-422 only, IC470A and IC473A models carry it on 5-position terminal blocks (strain relief included); IC630A models carry it on RJ-12 ("6-wire RJ-11") jacks; and IC631A models carry it on RJ-45 jacks. The IC471A and IC472A models carry either RS-422 or the transmit- and receive-data leads of RS-530 on DB25 female and DB25 male connectors respectively.

2.2 Features and Benefits

- Bidirectionally convert RS-232 signals to balanced RS-422 signals or RS-530 transmit- and receive-data signals.

- IC470A, IC471A, and IC472A models can be set as DTE or DCE on RS-232 side.

- Passes software flow control, loops back RS-232 hardware flow-control signals.

- Data rates to 19,200 bps; RS-422/530 distances to 4000 ft. (1219 m).

- Powered through its RS-232 interface.

- Extremely compact.

- Models available with a variety of RS-422/530 connectors and either DB25 or DB9 RS-232 connectors.

3. Configuration (Models with RS-232 on DB25 Only)

The Async RS-232↔RS-422 Converters and Async RS-232↔RS-422/RS-530 Converters are easy to use. They have no internal jumpers or DIP switches to set, so you won't need to open the case at all unless your unit has terminal-block connectors (see **Section 4.1.3**).

You will have to configure units that carry RS-232 on DB25 connectors—IC470A, IC471A, and IC472A models—as DTE or DCE, using their external DTE/DCE switch. (The IC473A, IC630A, and IC631A models, which carry RS-232 on DB9, are always DCE and have no such switch.)

Refer to Figure 3-1 on the next page: If you'll be plugging the Converter into a DTE such as a computer, terminal, or serial printer, make sure the Converter's DTE/DCE switch is in the complementary "DCE" setting. ("DCE" is the factory-default setting for this switch.) If you'll be plugging the Converter into a DCE such as a modem or multiplexor, make sure the switch is in the "DTE" setting.
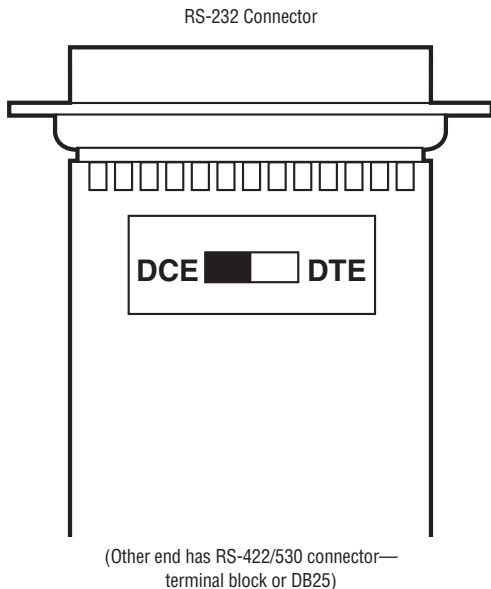
RS-232 Connector

(Other end has RS-422/530 connector—
terminal block or DB25)

**Figure 3-1. The DTE/DCE switch on the IC470A, IC471A,
and IC472A models of the Converter.**

4. Installation

4.1 Connecting Cables to the RS-422 or RS-530 Interface

The Converter can communicate with another RS-422 or RS-530 device as far away as 4000 feet (1219 m). To do this, the cable you run between them must contain two twisted pairs of dry, unconditioned metallic wire with a gauge between 19 and 26 AWG. Once you terminate it properly, bulk Category 3 UTP cable such as our product code EYN712A should do fine.

IMPORTANT NOTE

Please be aware, as you run RS-422 cable from the Converter to the RS-422 device, that the Converter's polarity might be the reverse of the device's. If connecting + to + and – to – doesn't work, try connecting + to – and – to +.

Different models of the Converter have different RS-422 and RS-530 interface connectors:

- IC470A and IC473A models have a 5-position terminal block with strain relief.

- IC471A models have a DB25 female connector.

- IC472A models have a DB25 male connector.

- IC630A models have an RJ-12 ("6-wire RJ-11") jack.

- IC631A models have an RJ-45 jack.

For models whose RS-232 and RS-422/530 connectors are both DB25 male (IC472A-M) or DB25 female (IC471A-F), the connector farthest from the DTE/DCE switch is the RS-422/530 connector.

4.1.1 MAKING AN RS-422 OR RS-530 CONNECTION TO A DB25 (IC471A AND IC472A MODELS)

The IC471A and IC472A models of the Converter have DB25 female and DB25 male RS-422/530 connectors respectively. These are pinned according to RS-530, although only the transmit- and receive-data signals are supported. When you run cable from the Converter to another RS-422 or RS-530 device, make sure the cable is pinned as shown below, with the XMT→RCV wires in one pair and the RCV←XMT wires in another pair:

RS-530 Signal	DB25 Pin	RS-422 Signal	RS-422 Signal	DB25 Pin	RS-530 Signal
TD A	2	XMT+ ....>.......RCV A+		3	RD A
TD B	14	XMT− ....>.......RCV B−		16	RD B
RD A	3	RCV+ ....<........XMT A+		2	TD A
RD B	16	RCV− ....<.........XMT−		14	TD B

4.1.2 MAKING AN RS-422 CONNECTION TO AN RJ-12 (IC630A MODELS) OR RJ-45 (IC631A MODELS)

The IC630A and IC631A models of the Converter have RJ-12 ("6-wire RJ-11") female and RJ-45 female RS-422 connectors respectively. These are pinned in a USOC style for a standard telco wiring environment, as shown below:

```
        IC630A:   IC631A:
        RJ-12     RJ-45      Lead/
         Pin       Pin       Signal

                    1-----------N/C
        1 -----------2 --------GND*
        2 -----------3 --------RCV–
        3 -----------4 --------XMT+
        4 -----------5 --------XMT–
        5 -----------6 --------RCV+
        6 -----------7 --------GND*
                    8-----------N/C
```

*You don't have to connect the GND (ground) pins to anything; ground connections are strictly optional, although you can connect a cable shield to ground *at one end only*.

In most modular RS-422 applications, you'll need to run a "crossover" cable between the Converter and the other RS-422 device. This cable should be pinned as shown below for the IC630A models, and as shown on the next page for the IC631A models, with the XMT→RCV wires in one pair and the RCV←XMT wires in another pair:

<u>IC630A: RJ-12*</u>

Lead/ Signal*	Pin No.*	Pin Color†		Pin Color†	Pin No.*	Lead/ Signal*
XMT+	3	Green	........>........	Black	5	RCV+
XMT−	4	Red	........>........	Yellow	2	RCV−
RCV+	5	Black	........<........	Green	3	XMT+
RCV−	2	Yellow	........<........	Red	4	XMT−
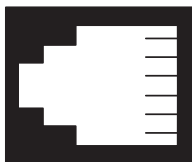
1 Blue*
2 Yellow
3 Green
4 Red
5 Black
6 White*

*If the cable is shielded, you can attach *one end* of the shield to GND (ground, Pin 1 or Pin 6). Do *not* run wire from a ground at one end of the cable to a ground at the other end; the Converter does not reference ground for RS-422 data transmission and you could create an electrical "ground loop" that could severely damage your equipment.

†These are standard AT&T® color codes. The RJ-45 connectors on your cables or other equipment might have different-colored pins.

RS-232↔RS-422 INTERFACE CONVERTERS

<u>IC631A: RJ-45</u>

Lead/ Signal*	Pin No.*	Pin Color†		Pin Color†	Pin No.*	Lead/ Signal*
XMT+	4	Red	>	Yellow	6	RCV+
XMT−	5	Green	>	Black	3	RCV−
RCV+	6	Yellow	<	Red	4	XMT+
RCV−	3	Black	<	Green	5	XMT−
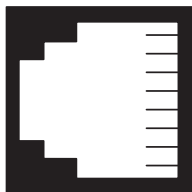
1 Blue*
2 Orange*
3 Black
4 Red
5 Green
6 Yellow
7 Brown*
8 Slate*

*If the cable is shielded, you can attach *one end* of the shield to GND (ground, Pin 2 or Pin 7). Do *not* run wire from a ground at one end of the cable to a ground at the other end; the Converter does not reference ground for RS-422 data transmission and you could create an electrical "ground loop" that could severely damage your equipment.
   Also, remember that Pins 1 and 8 are not connected to anything inside the Converter, so do not connect any wires to them.

†These are standard AT&T® color codes. The RJ-45 connectors on your cables or other equipment might have different-colored pins.

4.1.3 MAKING AN RS-422 CONNECTION TO A 5-POSITION TERMINAL BLOCK (IC470A AND IC473A MODELS)

If your RS-422 application requires you to attach two pairs of bare wires to a Converter model whose RS-422 connector is an internal terminal block, you will need to open the Converter's case, connect the wires to the block, and fasten a strain-relief collar in place so that the wires won't pull loose. Take these steps:

1. Open the unit by gently inserting a screwdriver between the DB25 or DB9 connector and the lip of the plastic case, as shown below and at the top of the next page. You don't have to worry about breaking the plastic, but be careful not to bend the connector. Once you've opened the unit, you should be able to see the terminal block located at the near end of the Converter's printed circuit board.
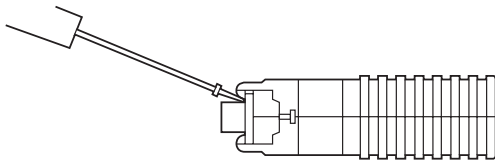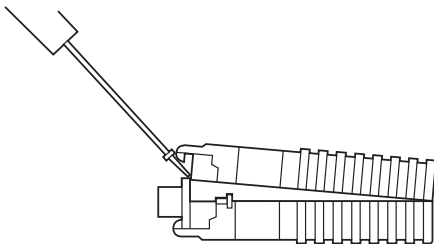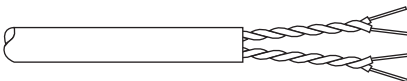
2. Strip the jacket and outer insulation from the last inch or so (~2.5 cm) of the twisted-pair cable:
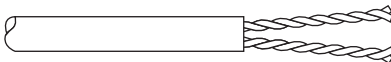
3. Strip the insulation from the last quarter-inch or so (~0.6 cm) of each of the cable's wires:

4. Connect *one pair* of wires to the XMT A and XMT B terminals on the terminal block, noting carefully which color wire goes to which terminal. Similarly, connect the *other pair* of wires to the RCV A and RCV B terminals. Note that the ordering of the terminals is reversed in the IC473A-M as opposed to the IC473A-F and the IC470A models:


IC473A-M

IC473A-F, IC470A-M/F
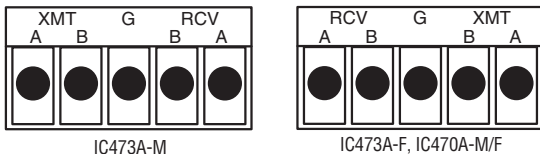
Note that when you connect the cable at the other end, you'll want to cross-pin the wires this way, with the XMT→RCV wires in one pair and the RCV←XMT wires in another pair:

| Converter	RS-422 Device
XMT A (+) ....>............RCV+	
XMT B (−) ....>............RCV−	
RCV A (+) ....<............XMT+	
RCV B (−) ....<............XMT−	

5. If the cable is shielded, you can (if you want) connect the shield to ground *at one end of the cable only*—at the Converter's "G" terminal, for example. This is strictly optional; the Converter doesn't require that you use shielded cable, or a cable with a ground wire, to operate properly.

Do *not* connect a cable shield or a ground wire to ground at both ends of the RS-422 cable. The Converter does not reference ground for RS-422 data transmission and you could create an electrical "ground loop" that could severely damage your equipment.

6. When you finish connecting the wires to the terminal block, the Converter assembly should resemble the appropriate illustration below. (Here and throughout the rest of this section, the two types of Converter models are not shown to scale with each other.)


IC470A models

IC473A models
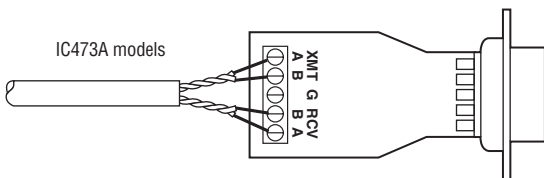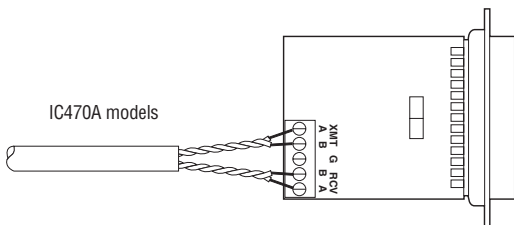
7. Place the two halves of the included strain-relief assembly on either side of the telephone wire and press the halves together *very lightly.* As shown below, slide the strain-relief assembly so that it is close to the terminal block—about two inches (~5 cm) away for the IC470A models, right to the edge of the board for the IC473A models. Now press the halves of the assembly together *firmly.* (If at this point it becomes clear that your cable is too thin or too thick to be used with this strain relief, call Black Box Technical Support.)
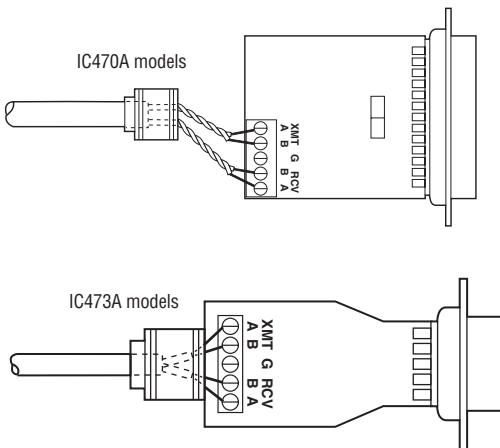
8. Insert the strain-relief assembly, with the wire going through it, into the matching slot in the bottom half of the Converter case. Set the whole circuit-board/cable-end/strain-relief assembly back into the bottom of the case, as shown below:

IC470A models

IC473A models
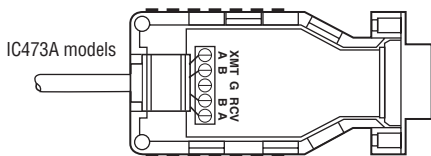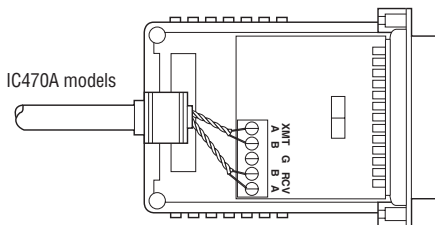
9. Bend the top half of the Converter's case as necessary to place it over the strain-relief assembly, as shown below. Do *not* snap the case together yet.
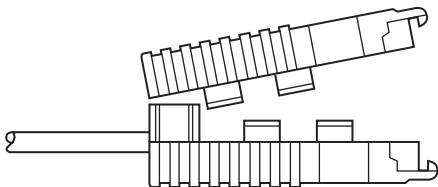
10. The Converter comes with a pair of screws and saddle washers. Put one of the washers on one of the screws. Insert that screw through the matching hole on one side of the DB25 end of the case, then snap that side of the case closed. Repeat the process for the other side with the other screw and washer.

This completes your RS-422 terminal-block cable installation.

4.2 Connecting Devices or Cables to the RS-232 Interface

Once you've connected the RS-422 or RS-530 cable, and (for IC470A through IC472A models) have configured the Converter for DTE or DCE, simply plug the Converter directly into a DB25 or DB9 serial port on the RS-232 device. After doing so, remember to insert and tighten the two captive screws ("screwlocks") on the connector.

NOTE

If you must use a cable to connect the Converter to the RS-232 device, make sure it is a *straight-through-pinned* cable of the shortest possible length. We recommend the cable not be more than 6 ft. (1.8 m) long.

Refer to **Appendix B** for pinouts of the Converter's RS-232 interfaces.

5. Operation

Once the Converter is properly installed, it should operate transparently—as if the two attached devices were connected to each other with a simple cable. The Converter gets its operating power from the RS-232 data and control signals; it has no ON/OFF switch, so it will begin operating as soon as the RS-232 device powers up.

The Converter passes through all data signals from the RS-232 and RS-422 interfaces, including any software flow-control information. It loops back all hardware flow-control signals from the RS-232 interface—it *does not* pass them. It doesn't support any other signals.

6. Troubleshooting

6.1 Calling Black Box

If you determine that your Converter is malfunctioning, *do not attempt to alter or repair the unit.* It contains no user-serviceable parts. Contact Black Box Technical Support at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem;

- when the problem occurs;

- the components involved in the problem;

- any particular application that, when used, appears to create the problem or make it worse; and

- the results of any testing you've already done.

6.2 Shipping and Packaging

If you need to transport or ship your Converter:

- Package it carefully. We recommend that you use the original container.

- Before you ship the unit back to Black Box for repair or return, contact us to get a Return Authorization (RA) number.

Appendix A: Cable Guidelines

The Converter operates at frequencies of 20 kHz or less and has been performance-tested for RS-422/530 using twisted-pair cable with the following characteristics:

Wire Gauge	Capacitance	Resistance
19 AWG	83 nF/mi or 15.7 pF/ft. (51.6 nF/km or 49.9 pF/m)	16.3 mΩ/ft. (53.5 mΩ/m)
22 AWG	83 nF/mi or 15.7 pF/ft. (51.6 nF/km or 49.9 pF/m)	32.6 mΩ/ft. (107 mΩ/m)
24 AWG	83 nF/mi or 15.7 pF/ft. (51.6 nF/km or 49.9 pF/m)	51.7 mΩ/ft. (169.5 mΩ/m)

To get optimum performance from the Converter, keep these guidelines in mind:

- Always use twisted-pair wire—this is *not* an option.

- Use twisted-pair wire with a capacitance of 20 pF/ft. or less.

- Avoid twisted-pair wire thinner than 26 AWG (that is, avoid higher AWG numbers than 26).

- Using twisted-pair cable with a resistance greater than that specified in this appendix might reduce the RS-422/530 distance you can run, to below the normal maximum of 4000 ft. (1219 m), but the function of the Converter shouldn't be affected otherwise.

Appendix B: RS-232 Pinouts

B.1 Pinout on DB25 (IC470A through IC472A Models)

The IC470A, IC471A, and IC472A models of the Converter have a standard RS-232 interface pinned out, as shown on the next page, on a DB25 female (pictured) or male connector.

When the Converter is set as DTE, it transmits data to the attached RS-232 device on Pin 2 (Transmit Data, TD) and receives data from that device on Pin 3 (Receive Data, RD). When the Converter is set as DCE, it receives data on Pin 2 and transmits on Pin 3.

Two sets of RS-232 control signals, RTS/CTS and DTR/DSR/CD, are jumpered together inside the Converter. If the Converter receives Request to Send (RTS) on Pin 4, the Converter loops it back on the Clear to Send line (CTS, Pin 5), and vice versa. If the Converter receives a control signal on either Data Terminal Ready (DTR, Pin 20), Data Set Ready (DSR, Pin 6), or Carrier Detect (CD, Pin 8), the Converter loops it back to any of these three lines on which it is *not* receiving a signal.

RS-232↔RS-422 INTERFACE CONVERTERS

Set as DTE

Dir.	Signal Name (Abbrev.)	Pin		Pin	Signal Name (Abbrev.)	Dir.
				1 – Frame Ground (FGND)		N/A
				2 – Transmit Data (TD)		OUT
				3 – Receive Data (RD)		IN
				4 – Request to Send (RTS)		OUT
				5 – Clear to Send (CTS)		IN
				6 – Data Set Ready (DSR)		IN
OUT	Data Term. Ready (DTR) – 20			7 – Signal Ground (SGND)		N/A
				8 – Carrier Detect (CD)		IN

Set as DCE

Dir.	Signal Name (Abbrev.)	Pin		Pin	Signal Name (Abbrev.)	Dir.
				1 – Frame Ground (FGND)		N/A
				2 – Transmit Data (TD)		IN
				3 – Receive Data (RD)		OUT
				4 – Request to Send (RTS)		IN
				5 – Clear to Send (CTS)		OUT
				6 – Data Set Ready (DSR)		OUT
IN	Data Term. Ready (DTR) – 20			7 – Signal Ground (SGND)		N/A
				8 – Carrier Detect (CD)		OUT

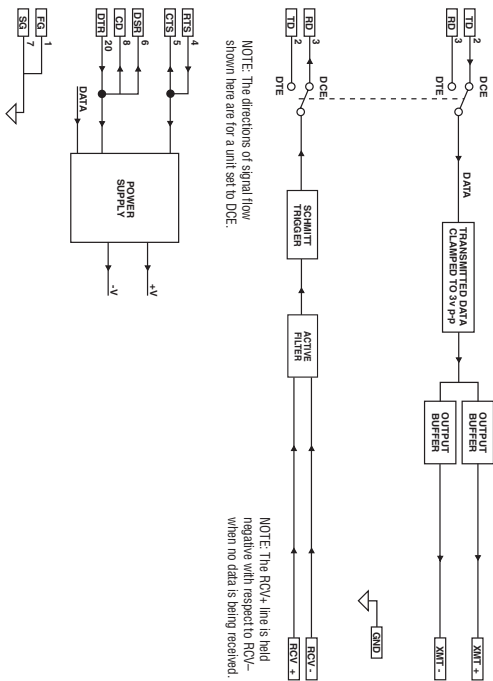## B.2 Pinout on DB9 (IC473A, IC630A, and IC631A Models)

The IC473A, IC630A, and IC631A models of the Converter have an RS-232 interface pinned out according to the TIA-574 standard, as shown below, on a PC-compatible DB9 female (pictured) or male connector.

These models of the Converter are always DCE; they receive data on Transmit Data (TD, Pin 3) and transmit on Receive Data (RD, Pin 2). Two pairs of RS-232 control signals, RTS/CTS and DTR/CD, are jumpered together inside the Converter. If the Converter receives Request to Send (RTS) on Pin 7, the Converter loops it back on the Clear to Send line (CTS, Pin 8), and vice versa. And if the Converter receives Data Terminal Ready (DTR, Pin 4), the Converter loops it back on the Carrier Detect line (CD, Pin 1). Also, if the converter receives signals on any of these lines or on TD (Pin 3), it emits a small positive voltage on the Data Set Ready (DSR, Pin 6).
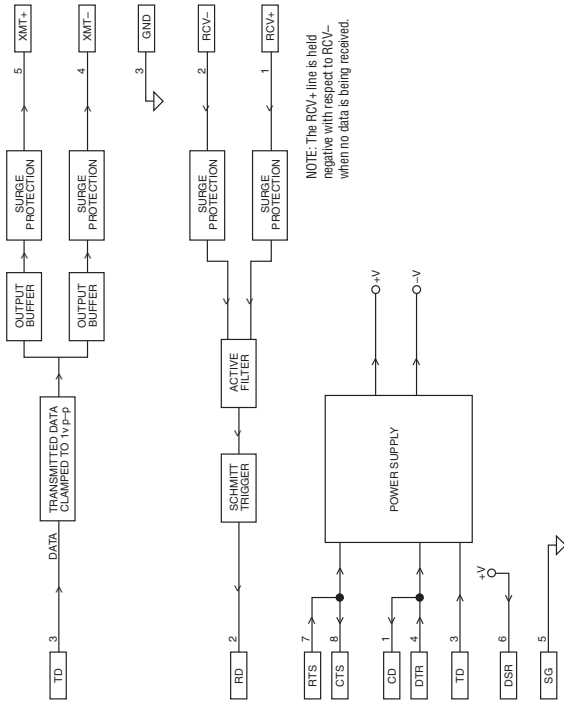
Dir.	Signal Name (Abbrev.)	Pin		Pin	Signal Name (Abbrev.)	Dir.
OUT	Data Set Ready (DSR)	6		1	Carrier Detect (CD)	OUT
IN	Request to Send (RTS)	7		2	Receive Data (RD)	OUT
OUT	Clear to Send (CTS)	8		3	Transmit Data (TD)	IN
				4	Data Term. Ready (DTR)	IN
				5	Signal Ground (SGND)	N/A

Appendix C: Block Diagrams

C.1 IC470A through IC472A Models

NOTE: The directions of signal flow shown here are for a unit set to DCE.

NOTE: The RCV+ line is held negative with respect to RCV– when no data is being received.

C.2 IC473A, IC630A, and IC631A Models

NOTE: The RCV+ line is held negative with respect to RCV– when no data is being received.